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ABSTRACT

This report presents a summary description of the 1974-75 Michigan Cost-Effectiveness Study and its findings. The study was an effort to develop and implement evaluation techniques for determining what educational practices affect student behavior and what costs are associated with those practices. Overall purpose of the 1974-75 study was to continue development of the analytical techniques reflected in the cost-effectiveness model that was employed in the 1973-74 Michigan Cost-Effectiveness Study. A critical part of this continued development was an attempt to cross-validate the variables identified in the 1973-74 study. In addition, the 1974-75 study also sought to identify new variables related to student achievement and to investigate the relationships between achievement and various identified variables. Data for the study were collected from 25 Michigan school districts with highly successful compensatory education reading programs and 25 districts with highly unsuccessful programs. Within each of these districts, the highest and lowest achieving buildings were selected for study. The study focused on only those educational variables subject to control by the schools and did not examine variables such as race or socioeconomic status. (Author/JG)

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THE STUDY OF SCHOOL EFFECTIVENESS: MICHIGAN COST-EFFECTIVENESS STUDY

April, 1976

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Michigan Department of Education

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THE STUDY OF SCHOOL EFFECTIVENESS: MICHIGAN

SECTION I

INTRODUCTION

The purpose of this report is to provide a summarized description of the 1974-75 Michigan Cost-Effectiveness Study and its findings. This report is comprised of seven sections. In addition to this Introduction, there are:

Section II - Purpose of 1974-75 Study
Section III - Study Design for 1974-75
Section IV - Description of 1974-75 Sample
Section V - Cost Analyses
Section VI - Effectiveness Analyses
Section VII - Summary, Conclusions, and Recommendation

As was the case with the first year of the study, 1973-74, the 1974-75 study was restricted to compensatory education reading programs. The study was an effort to develop and implement evaluation techniques which can determine what educational practices bring about changes in student behavior and what costs are associated with those practices. Information about those educational practices and their associated costs would provide a rationale for planning. This rationale for planning would provide the base for educators to develop new programs and modify existing programs to improve services to students.

The Cost-Effectiveness Study focused upon educational variables which could be changed or controlled by educational systems. Variables such as race, social economic status, level of parental education, and so forth, which cannot be readily controlled or modified by an educational system were not examined. It was the intent of the study to examine those aspects of educational policy and practices which could be changed to bring about a higher quality of education for students.

The term program effectiveness, as used in this study, includes a consideration of both program success and activities associated with the program. Program success is attained when the objectives of a program are attained, i.e., an increase in student reading achievement. Program effectiveness required further investigation of the question, "Why was the program successful?" To be termed effective, the activities of the program must contribute to the success of the program, i.e., there is a strong indication that the activities brought about the achievement of the objectives.

Both successful and unsuccessful reading programs were included in the study. The question might be asked, "Why would someone want to look at unsuccessful programs if they were trying to find out what makes a successful program?" The answer to that question is fairly simple. If a person were to look at a group of successful reading programs, they would probably find that all of those successful programs have a program director, provide reading teachers, and provide an assortment of reading materials. However, if that same person were to look at unsuccessful reading programs, they would probably find that those programs also have a program director, have reading teachers, and provide an assortment of reading materials. The information obtained from examining the unsuccessful reading programs would show that having a program director, the presence of reading teachers, and an assortment of reading materials are not unique aspects of successful reading programs. Discovering what is unique about successful reading programs can only be accomplished by looking at both successful and unsuccessful programs.

SECTION II

PURPOSE OF 1974-75 STUDY

The purpose of the 1974-75 study efforts was the continued development of the analytical techniques reflected in the cost-effectiveness model. However, a critical part of this continued development was the cross-validation effort focusing upon the variables identified and reported in the executive summary[1] of the 1973-74 study. Thus, Section 6 of this report, which presents the results of this year's study, reports first on the results of this cross-validation effort. This order of reporting reflects the importance of cross-validation since without some evidence upon which to anchor the overall findings, evidence that involves the demonstration of significant results over more than one year of the study, it might well be argued that any other findings are greatly lessened in their impact.

Following, in importance, the cross-validation of the reported results of last year's effort is the identification of new variables which relate to achievement. Additionally, much of the discussion and analysis of Section V, dealing with the 1974-75 cost analysis, also is concerned with identifying new significant variables.

The bulk of the work reported in Section V details the extended relationships investigated between cost and achievement. This extension is one both of a refinement nature where data management and reduction techniques were involved and of a broadened analysis nature where costs provided from various funding sources are analyzed this year, a series of analyses not possible using last year's (1973-74) data.

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[1]Michigan Cost-Effectiveness Study: An Executive Summary, Michigan Department of Education, April, 1975.

The last of the three major purposes of the 1974-75 effort, the investigation of the direction of the relationships between achievement and various identified variables, is addressed in Section VI. Time constraints and the volume of data, with the concommitant data management needs, prevented all of the possible analyses from being completed. However, the development of the path models presented in Section VI do represent a major step in identifying the nature of the significant relationships between various variables and reading achievement.

The 1974-75 study effort was designed to meet these purposes: the extent to which each purpose has been met is well reflected in the pages that follow. The model, first began in the spring of 1972 and further developed through the 1973 pilot and the 1973-74 study effort, has seen still further developmental progress through the 1974-75 study effort. Instruments have been modified to remove uninteresting variables and pursue interesting areas in greater depth and further. Data management and analysis techniques have been simplified and refined. The cost analysis methodology has been critically examined, expanded to include estimates of costs provided from various funding sources, and refined through an overall improvement of the consistency of data collection and management techniques.

SECTION III

STUDY DESIGN FOR 1974-75

For the 1974-75 study year, a number of changes in the overall study design were carried out. During the previous study year one building per study site had been included in the sample. This building was the outlier building for that site, high achieving outlier for high achieving sites and low achieving outlier for low achieving sites. For the 1974-75 study year, two buildings per study site were included in the sample, both high and low achieving outliers from each site regardless of whether the site was selected as a high or low achieving site.

The move from one to two buildings per site had a direct impact on at least one aspect of the study sample for the 1974-75 year. A number of the districts included in the 1973-74 sample were districts which had only one elementary building. For the 1974-75 study year, though, no districts having only one elementary school were included in the study due to the requirement of two buildings per site. Thus, the study sample for the 1974-75 study year tended to include districts which on the average were larger than the previous year's study sample.

Selection of Sites and Scheduling Contacts

Following the overall dimensions intended for the 1973-74 study, the site selection process began with identifying 25 districts in Michigan highly successful in their compensatory education reading programs and 25 that were highly unsuccessful. Thirty six of these 50 districts were to be included for their Title I programs; fourteen for their Chapter 3 programs.

Similar to what was done in the previous year's effort, selection of the successful and unsuccessful Title I sites began by reviewing the 1973-74 Title I evaluation reports of the approximately 500 LEAs (Local Education Agencies) and LEA co-ops to rank the 36 highest achieving and 36 lowest achieving programs based on the average months gained per month in the program in reading achievement. The following guidelines were followed:

1) adequate program description had to be available for the district;

2) student population turnover for the district had to have been less than 40 percent;

3) the district had to have at least two schools;

4) each school had to have at least 2 grades between grades 2-6 with 15 or more compensatory education students in each grade, thus requiring a minimum of 20 students in the district's program;

5) reading test results on MDE acceptable reading tests were used for comprehension if available, for vocabulary if comprehension results were not available, or for total score if neither sub-test result was available;

6) the pre-test must have been given prior to December 1973;

7) at least 7 months had to have elapsed between pre and post tests;

8) where no specific date was specified for the month in which the tests were reported to have been administered, it was assumed that the test was administered in the middle of the month;

9) the program length was rounded to the nearest 0.5 month;

10) where specific test dates were provided it was assumed that the days of the month numbered from 1-10 is the beginning of the month, 11-15 is the middle of the month, and 21-31 is the end of the month;

11) months gained per month in the program was calculated for any grade level from grade 2 through 6 where at least 5 students participated in testing;

12) these grade averages, in turn, were averaged to form a program average; and

13) month per month gains were recorded to the nearest hundredth.

Use of these guidelines allowed the 72 Title I programs, 36 at each end of the achievement spectrum, to be identified, from which the desired level of 18 programs at each end would be selected.

Paralleling this detailed effort for the Title I programs, the 14 highest and 14 lowest achieving Chapter 3 districts were also identified. As was necessary last year, percentage of accomplishment was used to determine these performance levels rather than month per month gains. Reading achievement results were used to rank all Chapter 3 districts in terms of the percent of their Chapter 3 students reaching at least the 75% level of accomplishment. This ranking was then used to identify the desired Chapter 3 sites.

Both the Title I and Chapter 3 pools of sites were deliberately selected as being double the size needed to allow replacement of sites initially selected where additional program stability criteria caused a site to be dropped from the sample. The initial 50 sites, reflecting the dimension indicated in the opening paragraph of this discussion, were randomly selected from the pool of Title I and Chapter 3 sites just described.

Additional school level screening criteria were then applied to these sites through written and telephone contact. These criteria included:

1) the compensatory education program (Title I or Chapter 3) was in existence by the fall of 1973;

2) the program had the same key persons (e.g., reading coordinator) as in 1973-74; or the same key persons provide the same services to the program as were provided the previous year, even though these persons may hold different titles or be in different locations;

3) the school building had the same principal as in 1973-74;

4) teacher turnover in the building was less than 40 percent;

5) there were at least five compensatory education students per participating grade level; and

6) the materials used were essentially those used in the previous school year.

Through these written and telephone contacts, the selected districts were asked to identify their three highest achieving schools meeting the above listed criteria and their three lowest achieving schools meeting these same criteria. Direct contact with the identified buildings then allowed verification of the information provided by district level correspondents and, eventually, specification of the two schools to be studied per site.

Problems of program stability in the low achieving sites, similar to those encountered last year, prevented the desired 50 sites from being identified and included in the current year's study. Table 1 shows the results of the selection process just described. A total of 96 schools from 48 sites were thus selected including 36 schools from 18 high achieving Title I sites, 36 from 18 low achieving Title I sites, 14 from 7 high achieving Chapter 3 sites, and 10 from 5 low achieving Chapter 3 sites.

TABLE 1

SITE/SCHOOL SELECTION FOR 1974-75 STUDY

	TITLE I SITES		CHAPTER 3 SITES		TOTAL	
	No. of Sites	No. of Schools	No. of Sites	No. of Schools	No. of Sites	No. of Schools
High Achieving Sites	18	36	7	14	25	50
Low Achieving Sites	18	36	5	10	23	46
TOTAL	36	72	12	24	48	96

Selection and Training of Data Collectors

The data collection team for the 1974-75 study included six members. The on-site data collection activities of these individuals was supervised by the project's data coordinator. The individual serving as data coordinator was the same person who held this position during the previous year of the study; and four of the six data collectors were also data collectors for the study last year.

A one day training session was provided for all members of the data team. This session was supervised by Education Turnkey Systems, Inc.[2] principal investigator and conducted jointly by the project director and the data coordinator.

This training session covered a number of topics including:

1) a summary of the progress of the 1974-75 study since December of 1974;

2) a discussion of the history of the project through the 1973-74 effort;

3) a detailed description of the procedures to be followed in all aspects of this year's effort; and

4) a detailed review of the instruments to be used.

Collection of Data

Data collection took place between March and June of 1975. The procedures followed paralleled those of the 1973-74 effort with a site initially contacted by mail followed by a telephone contact made by the data coordinator. These initial mail and phone contacts, also described earlier in this section, were for the purpose of selection, verification of selection information, and scheduling of the on-site visit. Once both buildings for a site had been identified and scheduled for a visit, letters

[2]Most of the study activities were conducted by Education Turnkey Systems, Inc. under contract to the Michigan Department of Education.

were sent to the district's director of compensatory education and the principals of each study school confirming these arrangements and alerting these persons to data needs that they might more easily fulfill prior to the on-site visit. These needs were expressed as specific requests for enrollment data, roster of compensatory education students, and budget documents.

The typical site visit included interviews with one director, two principals, two compensatory education teachers, six to eight regular classroom teachers, three or four paraprofessionals, plus one other staff for a total of 16-17 such interviews. Last year's visit, confined to one day, included a total of 8-9 such interviews. The time required per interview this year matched closely last year's experience; generally about one hour was required per interview.

Once a data collector completed the interviews at a given site and had contacted the principals and director once again to make them aware of this fact, all responses were coded into the keypunch columns of the response sheets. These completed and coded response sheets were then forwarded to the data coordinator for processing. At this point an additional request for data was mailed to each district director. This request for specific salary data for the persons interviewed on-site. Salary amounts from specific fund sources and in total were requested. Also, 1973-74 test score results for the compensatory education students of the subject schools were requested at this time as well.

Because the results of the 1973-74 study were made public prior to the 1974-75 on-site visits, it was felt that some measure should be taken to determine the impact of this release on the level of awareness of the study on the part of all persons interviewed this year.

It would be important to know of this level of awareness in order to ascertain whether the results observed this year were contaminated by this public release of preliminary study information. The measure chosen was a simple question asked of each of the 808 respondents included in this year's study: "Are you familiar with the results of the first year of this study which were recently released?" The percent of respondents answering yes to this question is shown below for each type of respondent:

1) district directors of compensatory education (48 respondents) -- 15% said yes;

2) principals (96 respondents) -- 6% said yes;

3) compensatory education teachers (87 respondents) -- 5% said yes;

4) regular classroom teachers (356 respondents) -- 2% said yes;

5) paraprofessionals (184 respondents) -- 2% said yes; and

6) other staff (37 respondents) -- 5% said yes.

It was concluded from the above results that, below the level of district director of compensatory education, the study was not widely known, even after the public release of results and the publicity surrounding these results. Even at the directors' level it was not felt that the percent indicating awareness was high enough to cause concern over the issue of potential contamination.

Searching for Missing Data Items

All response sets were individually screened in order to identify all missing data items and any data inconsistencies. Once all response sets from a given data collector had been so screened, the data coordinator contacted the collector by phone and provided them their list of missing or inconsistent items for resolution. The data collectors

then set about to resolve these problems, either correcting mistakes in coding or obtaining additional data from the site in question, and telephone their responses to the data coordinator when this was done. In some instances, the missing items could not be provided by the original data collector. The data coordinator resolved all such outstanding data problems by directly contacting the site in question.

Reducing the Raw Data to Analyzable Form

As described earlier in this Section, the experience of the study team last year had led to a revision in the data collection/coding/reduction process which allowed keypunching of raw data responses to be done directly from the sheets filled out during the interviews. However, before cards could be keypunched from these forms, a number of steps still needed to be followed. Missing or inconsistent items had to be resolved as was just described. Additionally, the large number of open-ended responses included in this year's instruments had to be coded for purposes of analysis.

One of the key elements of the instrument revision process this year was the expansion of items found to be significant in last year's results. One method relied upon in this expansion or probing effort was the use of open-ended questions. For instance, since teacher morale was found to be significantly related to reading achievement, this year a question was added to the scaled morale response asking why the respondent thought morale was high (or low) in that school. More than 130 such open-ended items were included in the full set of six instruments used this year. Thus, a major task in reducing raw data to analyzable form was the development of codes for these open-ended responses and the assignment of these codes to the open-ended responses in each of 808 respondent sets. The codes were

developed by sampling a number of responses and obtaining a series of codes that fit this sample. The codes were then applied to the entire set of responses. For the most critical codes, a joint effort of the project director and the data coordinator resulted in a set of codes which were then field tested by two raters (or data reducers) on a sample of actual responses. An agreement level of 80% was set as an internal requirement for this field test in order to judge the acceptability of the codes. Where this level was not reached for a particular set of codes, the codes were rewritten in a manner that would serve to most enhance inter-rater agreements based on observed patterns of confusion or disagreement in the field test. Once the codes for all open-ended questions were developed, a staff of data reducers assigned a code to each open-ended response contained in the entire set of 808 respondent sets.

SECTION IV

DESCRIPTION OF 1974-75 SAMPLE

In this section of the report background data for the districts and school building included in this year's study are presented. The information shown in this section does not include data from four schools in two districts of the entire sample of 96 schools in 48 districts. These two sample sites (both low achieving Title I sites) had no program cost models built for them due to incomplete data. Since the discussion to follow in later sections refers to program cost differences across sites, it was felt that this discussion of background characteristics be restricted to the same sites included in the cost analyses.

Comparison of Districtwide Background Data

Table 2 shows the mean and standard deviation for each of the 13 districtwide characteristics for the 25 successful sites and the 21 unsuccessful sites for which program cost models could be constructed. Each of the 15 sets of contrasts of these background data from successful sites versus similar data from unsuccessful sites was tested to determine whether the observed differences in means between these two groups of sites was significant at the 0.05 level or lower. None of the comparisons resulted in a significant difference between the two groups of sites.

Comparisons of School-Level Background Data

Table 3 shows the mean and the standard deviation for each of 7 school-level characteristics for the 50 school buildings in the study sample from the 25 successful sites and the 42 school buildings from the 21 unsuccessful sites. Each of the 7 sets of contrasts of these school level background data for schools from successful sites versus

TABLE 2

1974-75 DISTRICTWIDE BACKGROUND DATA
SUCCESSFUL SITES VS. UNSUCCESSFUL SITES

BACKGROUND DATA ITEM	UNSUCCESSFUL SITES n=25 MEAN	UNSUCCESSFUL SITES n=25 S.D.	UNSUCCESSFUL SITES n=21 MEAN	UNSUCCESSFUL SITES n=21 S.D.
Median Family Income in District, Dollars Annually	10,019	1622.1	9,634	1360.8
Total General Fund Expenditure ($) per Student	1,284	286.1	1,153	227.8
Total Compensatory Education Expenditure ($) per Compensatory Education Student (Title I for Title I sites, Chapter 3 for Chapter 3 sites)	320	127.8	378	352.0
Number of Title I Students	356	477.5	459	646.3
Number of Chapter 3 Students	310	541.0	458	652.2
District Enrollment				
Kindergarten	334	221.4	313	315.5
Grades 1-6	1,979	1382.6	1,855	1962.0
Grades 7-12	2,019	1293.1	1,853	1948.5
K-12	4,332	2865.7	4,022	4216.7
Number of Elementary Schools in the District	6	4.8	6	5.9
Number of Title I Elementary Schools	4	2.9	4	2.2
Number of Chapter 3 Elementary Schools	3	5.6	4	6.7
Number of Elementary Schools Which Are Both Title I and Chapter 3	2	3.4	2	3.1

schools from unsuccessful sites was tested for significance. Only one of these contrasts shows a significant difference between the successful site schools and the unsuccessful site schools -- the number of full time equivalent (FTE) compensatory education paraprofessionals. The schools from low achieving sites average 4.01 FTE paraprofessionals while the high achieving sites average 2.28 FTE paraprofessionals. This finding is consistent with the results of the first year of this study.

1974-75 Achievement Results

As indicated earlier, a total of 96 schools in 48 sites were included in this year's study effort. Achievement results from the 1973-74 school year for the sites established whether a particular site was included as either a low achieving or high achieving site for this year's effort. As part of the overall data collection effort, building specific 1974-75 reading achievement results were obtained. The data requested for each of two schools (specifically named in the request) per site were:

1) the average gain (in grade equivalent units) for the compensatory education students served by the program of interest (Title I or Chapter 3) in reading achievement as measured by the standardized test used at that site; and

2) the administration dates of the pre and post tests which determined the above average gain scores.

These two items of data were combined into the success measure used in this study as follows:

$$\text{month/month gain} = \text{months gained/months in the program} = \frac{[\text{average gain score (converted to months)}]}{[\text{number of months between pre and post test (to the nearest half month with a maximum value of 10.0)}]}$$

TABLE 3

1974-75 BACKGROUND DATA FOR SAMPLE SCHOOLS
SUCCESSFUL SITES VS. UNSUCCESSFUL SITES

BACKGROUND DATA ITEM	SAMPLE SCHOOLS FROM SUCCESSFUL SITES n=50 MEAN	S.D.	SAMPLE SCHOOLS FROM UNSUCCESSFUL SITES n=42 MEAN	S.D.
Total Enrollment, K-6	425	183.0	443	259.0
Total Number of Compensatory Education Students, K-6	83	72.6	100	79.9
Percent of Total K-6 Enrollment Designated Compensatory Education	21	16.1	25	18.9
Total Number of Regular Classroom Teachers, K-6	16	6.2	16	8.8
Ratio of Total K-6 Enrollment to Total Number of Regular Classroom Teachers, K-6	26.9	3.2	28.5	4.5
Number of Full Time Equivalent Compensatory Education Teachers, K-6	1.18	0.88	0.82	0.93
Number of Full Time Equivalent Compensatory Education Paraprofessionals, K-6*	2.28	2.62	4.01	3.20

* Probability of observing this large a difference by chance is 0.006.

While data in terms of month/month gain were available for all 48 study sites this year on a district-wide basis and all 96 schools included in this year's study initially indicated that the necessary data for computing the above rates would be available for the 1974-75 school year, only 41 sites (82 buildings) were able to provide the necessary data for this task. The other seven sites either did not fulfill the data request, had switched to objective or criterion referenced tests, or reported fewer test scores than was the minimum study criterion

for this measure. For the 41 sites (82 schools) which reported the requested data, Table 4 shows the number of buildings reporting, mean and standard deviation for the month/month gain in Building 1 (nominally the highest achieving building at each site which met the study's selection criteria), Building 2 (nominally the lowest achieving building at each site), and Buildings 1 and 2 combined for the following groupings of sites:

1) high achieving Title I sites;
2) high achieving Chapter 3 sites;
3) low achieving Title I sites; and
4) low achieving Chapter 3 sites.

A major difference in scope between last year's and this year's study effort was indicated earlier in this section -- the inclusion of two schools per site. Tables 4 and 5 showed the difference in results on the average between the Building 1's and Building 2's for various groupings of sites. It is readily apparent from these data that the differences in achievement within sites (certainly within groups of sites) are much less than the differences between sites (or between groups of sites). Table 4 even indicates that for the low achieving Title I sites the nominally lowest achieving schools (Building 2's) averaged somewhat higher gains than did the nominally highest achieving schools (Building 1's) in those sites. Thus, the Building 1 (high)/Building 2 (low) designation does reflect 1974-75 reading achievement as it actually existed. In fact, viewing each of the six lines of Tables 4 and 5 as a possible test of whether any significant differences exist on the average between the Building 1 and Building 2 results from any given site, it is noteworthy that none of these six contrasts indicate any significant difference between

TABLE 4

1974-75 ACHIEVEMENT RESULTS (MONTH/MONTH GAIN)
BY BUILDING DESIGNATION AND
BY GROUPINGS OF SITES

GROUPINGS OF SITES	BUILDING 1 ONLY N	MEAN	S.D.	BUILDING 2 ONLY N	MEAN	S.D.	ALL STUDY BUILDINGS N	MEAN	S.D.
High achieving Title I sites	14	1.88	0.47	14	1.66	0.71	28	1.77	0.60
High achieving Chapter 3 sites	7	1.73	0.35	7	1.44	0.66	14	1.58	0.53
Low achieving Title I sites	15	1.01	0.40	15	1.07	0.29	30	1.04	0.35
Low achieving Chapter 3 sites	5	1.20	0.36	5	1.04	0.38	10	1.12	0.36

TABLE 5

1974-75 ACHIEVEMENT RESULTS (MONTH/MONTH GAIN)
BY BUILDING DESIGNATION FOR
HIGH ACHIEVING VS. LOW ACHIEVING SITES

GROUPINGS OF SITES	BUILDING 1 ONLY N	MEAN	S.D.	BUILDING 2 ONLY N	MEAN	S.D.	ALL STUDY BUILDINGS N	MEAN	S.D.
High Achieving Sites	21	1.83	0.43	21	1.58	0.69	42	1.71	0.58
Low Achieving Sites	20	1.06	0.39	20	1.06	0.30	40	1.06	0.35

buildings. It appears that while there was a significant difference between the reading achievement of school districts, there was not significant difference between the reading achievement of the pairs of schools within school districts.

With this result in mind, the possibility of using both buildings from any given site as a reflection of the overall success level of that site was investigated. The upper right hand figures of Table 5 show the result of combining the results from all Building 1's and all Building 2's at high achieving sites and using the combined results to represent the achievement of the successful study sites. The lower right hand figures show the similar results in the low achieving sites.

SECTION V

COST ANALYSES

In this section of the report, the cost analyses of the compensatory education reading programs in this year's sample are described. Before specific cost data are presented, the cost methodology used in the study will be discussed. This discussion will allow those readers unfamiliar with program cost analysis to better understand the results that follow. Following the discussion, four analyses, all under the overall heading of cost analysis, are presented. The first analysis deals with comparisons of total program costs between the high achieving and the low achieving programs and between Title I and Chapter 3 programs. The second analysis deals with the similar comparisons but uses five separate subtotals which make up the total program cost (subtotals that reflect the cost of specific activities comprising the overall program) as the basis for comparison. The third analysis deals again with similar comparisons but uses four other subtotals which also add to the total program cost (in this case the subtotals reflect the amount of resources from various funding sources that make up the total program cost) as the basis for comparison. The last of these analyses examines the relationship between total program cost (as well as each of the nine different cost subtotals alluded to above) and the month/month gain results presented in the previous section.

Methodology

This study determined the cost of all resources devoted to reading instruction for compensatory education students for each school in the study. The phrase "cost of all resources devoted to reading instruction for compensatory education students" has a very specific meaning which

the reader should clearly understand. An academic program, as viewed by an individual student, may be considered as a set of resources all brought to bear upon a specific objective. For this study the objective deals with learning to read.

What are these resources? An obvious list of such resources might include: books, audio visual equipment, consumable supplies, etc. At least as important, though somewhat less obvious, would be the following resources:

1) the time of teachers spent in the classroom actually providing the instruction;

2) the time of paraprofessionals in this same regard; and

3) the time of anyone else who actually has student contact for this instruction.

Even less obvious are the following resources which the student may or may not actually see but which are as surely devoted to this specific academic program as are the above items which involved student contact:

1) staff time spent in planning the instructional program;

2) staff time of these personnel spent in training for this program plus training materials or consultants;

3) staff time spent in making the decisions necessary for the operation of the program -- decisions on materials, classroom organization, training agendas, etc.; and

4) the time of administrators in the overall administrative activities necessary for the operation of the program.

Each of the resources listed above has a cost associated with it; books and materials have prices; consultants have fees; and personnel are paid salaries which incur fringe benefit costs. The problem can be viewed as one of first identifying how much of a given resource (e.g., how many books, how much time) is devoted to the program and then determining the cost of this amount of resources by using the "price" associated with that resource. For instance, if a principal devotes ten percent of his

time to an activity specifically related to the compensatory education reading program in that school, then ten percent of the salary and fringe benefit costs associated with the principal would be considered part of the total cost of the program. For ease of comparison between programs, the cost figure just arrived at could be divided by the number of students served in that building to obtain the cost per student for that resource.

Table 6 shows the format that can be used for summarizing this costing process when applied to any given compensatory education reading program. The first column lists the potential resources that could be allocated to some degree to a compensatory education reading program. The next five columns list the activities (called "Functions" in Table 6) which comprise the overall program. The total amount of each resource allocated to each activity per student would be determined using a variety of cost data obtained from the district and school in question. A number of cells in Table 6 have been crossed out; these are cells which have no logical basis (e.g., consuming books and audiovisual software during administrative activities). Only the 34 resource/function cells not crossed out in this table are needed to obtain an estimate of the overall program cost per student (as well as function and resource subtotals).

The data used for building the cost models was obtained from a variety of sources. Local budgets, both general fund and compensatory education, were obtained from each site. Resource totals used in many of the 34 cells of Table 6 were obtained directly from these budgets combined with district and school compensatory education and total enrollment figures. In all 48 sites the appropriate compensatory education budget for 1974-75 was obtained; and in 47 of the 48 sites the 1974-75 general fund budget was obtained.

TABLE 6

PROGRAM COST ANALYSIS STRUCTURE

DOLLARS PER COMP-ED STUDENT ANNUALLY	FUNCTIONS						
RESOURCES	COMP-ED READING	COMP-ED PLANNING	COMP-ED TRAINING	COMP-ED DECISION MAKING	COMP-ED ADMINISTRATION	RESOURCE TOTAL	PERCENT OF TOTAL COST
PERSONNEL							
District Comp-Ed Director	X	11	17	24	30		
Principal	X	12	18	25	31		
Comp-Ed Teacher	1	13	19	26	X		
Regular Teacher	2	14	20	27	X		
Paraprofessional	3	15	21	28	X		
Other Staff	4	16	22	29	32		
CONSUMABLES							
Comp-Ed Books and AV Software	5	X	X	X	X		
Regular Books and AV Software	5	X	X	X	X		
EQUIPMENT							
Comp-Ed AV Equipment	7	X	X	X	X		
Other Comp-Ed Instructional Equipment	8	X	X	X	X		
Regular AV Equipment	9	X	X	X	X		
Other Instructional Equipment	10	X	X	X	X		
Comp-Ed Administration Equipment	X	X	X	X	X		
MISCELLANEOUS							
Miscellaneous Comp-Ed Training Expenses	X	X	X	X	X		
Miscellaneous Comp-Ed Administrative Expenses	X	X	X	X	34		
PUNCTION TOTAL							
PERCENT OF TOTAL COST							

Another major data source for this year's cost models was a salary listing obtained from each site for all personnel interviewed. These data included not only the total 1974-75 salary from all sources but also the specific contribution to that total from local sources, Title I funds, Chapter 3 funds, or other fund sources (such as the Section 43 state funded reading program). Salary data were obtained from 47 of the 48 sites for all personnel interviewed in the course of the on-site data collection effort. These data, coupled with the fringe rate data, were used to establish a "price" for each staff time resource identified in the study as being allocated to the compensatory education program at that school or site.

These staff time allocation estimates were obtained in a number of ways. For the classroom reading activity, estimates were obtained from all teaching personnel interviewed as to the amount of time compensatory education setting, daily. Averages for these individual estimates were used for each program to determine the total hours of reading instruction received each year by each compensatory education student in that program. Further data from each of these same teaching personnel regarding their actual student contact time for compensatory education reading allowed an average staff ratio during reading instruction to be obtained, which together with the "price" data described above produced the classroom reading portion of these resource costs.

For the time allocations not involving student time, each person interviewed provided estimates of the percent of their available time (i.e., working time not in contact with students) they devoted to the following activities:

1) planning for compensatory education reading and other programs;

2) training for such programs;

3) decision making related to such programs; and

4) administrative duties related to such programs.

Coupled with data on the actual amount of available working hours each year for that person, the total time devoted by that person to each of these activities was determined. Using this as a basis, the program total for this allocation was determined taking into consideration the total such persons serving the program being studied (e.g., if the average time devoted each year to planning for compensatory education reading was 25 hours per regular classroom teacher and 10 of the buildings 16 regular teachers served compensatory education students in their reading instruction, a total of 250 regular teacher hours was devoted to this activity yearly for that program). The cost of this total was then "priced" using the salary/fringe data described above and allocated to the number of compensatory education students served by that program in order to obtain further entries for Table 6.

Once all of the cost calculations for all resources in all activities (or functions) were completed, the COST-ED Methodology[3] produces a completed version of Table 6 for each compensatory education reading program modeled. A total of 92 such models were built; two sites did not provide sufficient data to allow cost models to be constructed -- one due to a missing general fund budget, and one due to missing salary data -- for the four schools included in the study from these two sites.

Additionally, the salary data by fund source along with the budget documents allowed estimates to be made of the portion of each resource total included in the total program cost (the next to last column of Table 6) form each of these four funding sources: local general fund,

[3] A proprietary process developed by Education Turnkey Systems, Inc.

Title I, Chapter 3, and other. These fund subtotals by resource were then summed over all resources to obtain an estimate of the amount from each of these fund sources reflected in the total program cost.

In order to assess whether significant differences in total program costs exist in the 1974-75 study sample, Table 7 was produced by combining all high achieving groups of sites together and contrasting these costs to those for all low achieving sites combined. A comparison of total program costs for high achieving sites and low achieving sites shows that the probability of obtaining the observed difference by chance is .002. In other words, the total program cost for high achieving sites was significantly greater than the total program cost for low achieving sites.

TABLE 7

1974-75 TOTAL PROGRAM COSTS (DOLLARS PER STUDENT ANNUALLY)
HIGH ACHIEVING VS. LOW ACHIEVING SITES

GROUPINGS OF SITES	ALL STUDY BUILDINGS		
	N	MEAN	S.D.
High Achieving Sites	50	635.1	345.8
Low Achieving Sites	42	458.9	177.5

Comparisons of Costs of Specific Activities

Table 8 shows the cost results for each of five specific activities which make up the total compensatory education reading program. These activities were discussed in the methodology portion of this report and correspond to the first five column totals of Table 6 for each of the program cost models built. The results included in Table 8 are for the 46 sites (92 schools) for which cost data were available. The bottom line of Table 8 shows four of these five contrasts to be significant

TABLE 8

1974-75 SPECIFIC ACTIVITY COSTS (DOLLARS PER STUDENT ANNUALLY)
FOR HIGH ACHIEVING VS. LOW ACHIEVING SITES

GROUPINGS OF SITES	CLASSROOM READING ACTIVITIES		PLANNING FOR COMP ED READING		TRAINING FOR COMP ED READING		DECISION MAKING FOR COMP ED READING		ADMINISTRATIVE ACTIVITIES FOR COMP ED READING		ALL COMP ED READING ACTIVITIES
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D	MEAN	S.D.	MEAN
High Achieving Sites (n=25)	306.2	164.7	154.5	106.6	31.3	33.0	101.6	102.7	41.5	49.3	635.1
Low Achieving Sites (n=21)	262.0	122.3	106.2	91.1	21.3	17.2	42.8	27.9	26.5	29.1	458.9
Probability of Observing a Cost Difference of this Size Favoring the High Achieving Sites by Chance	0.0777		0.012		0.040		0.0003		0.043		

at the 0.05 level or lower. Thus, for specific planning, training, decision making, and administrative activities related to the compensatory education reading program, the high achieving sites devoted significantly more resources than did the low achieving sites. For classroom (student contact) reading activities, the high achieving sites devoted more resourses than did the low achieving sites; but the difference was not significant at the 0.05 level.

Comparisons of Cost Provided From Various Funding Sources

Table 9 shows the portion of total compensatory education reading program costs provided from each of four funding sources. These funding sources are local general fund monies, Title I funds, Chapter 3 funds, other fund sources (mostly the state funded Section 43 reading program). The results included in this table are for the same 46 sites (92 schools) whose program cost models have been discussed before in this section. In order to assess whether significant differences in costs provided from various funding sources exist in the 1974-75 study sample, Table 9 was produced by combining all high achieving groups of sites and contrasting these costs from various funding sources with those for all low achieving sites combined. The mean values shown in the first four columns of Table 9 add to the mean values shown in column five. Three of the four fund categories considered in this table show the high achieving sites have significantly (at the 0.05 level) larger amounts of program costs provided from these funds than in the case in the low achieving sites. Only the costs provided from Chapter 3 funds show no difference between the high and low achieving sites. Actually more Chapter 3 funds are allocated to the compensatory reading programs in low achieving sites in the study sample though the difference is not statistically significant.

TABLE 9

1974-75 COSTS PROVIDED FROM VARIOUS FUNDING SOURCES
(DOLLARS PER STUDENT ANNUALLY)
FOR HIGH ACHIEVING VS. LOW ACHIEVING SITES

GROUPINGS OF SITES	LOCAL GENERAL FUNDS		TITLE I FUNDS		CHAPTER 3 FUNDS		OTHER FUND SOURCES		TOTAL PROGRAM COSTS
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN
High Achieving Sites (n=50)	355.0	197.2	223.0	202.7	26.8	45.3	30.3	77.2	635.1
Low Achieving Sites (n=42)	276.9	118.3	142.7	129.6	36.3	68.8	3.0	7.7	458.9
Probability of Observing a Cost Difference of This Magnitude by Chance	0.014*		0.015*		0.434*		0.013*		

*Where the cost difference favored the high achieving sites.

The results shown in this table -- that high achieving compensatory education programs receive significantly higher allocations of general funds, Title I funds, and funds from other fund sources (other than Chapter 3 funds) are especially interesting in light of the analysis previously presented. In that previous analysis it was pointed out that the total general fund expenditures per student annually in the high achieving sites, while somewhat greater than those in low achieving sites, were not significantly different from those in low achieving sites. Yet, at the program level, the analysis presented indicated that within this overall funding context, where no significant differences were found, significantly more local general funds were allocated to the compensatory education reading program in the high achieving sites than in the low achieving sites. These two results are important for they indicate that different allocation patterns within a general context of equal total funding may produce differential program results; i.e., more important than how much money is spent overall is the actual amount allocated to a specific program. The data for each of the two years of this study indicate that where significantly more resources are allocated to a specific program (in this case compensatory education reading), the districts having approximately equal background levels of funding, significantly greater achievement in reading for compensatory education students are also observed.

The results shown in Table 9 regarding Chapter 3 funding reflects the nature of the Chapter 3 program. Given a fixed ceiling of $200 per student, a much lower level of funding than Title I, wide variations in allocations of Chapter 3 funds are less possible, thereby making significant differences less likely to be observed. The fact that low achieving sites in the study sample actually were allocated slightly

higher levels of Chapter 3 funds also reflects the nature of the Chapter 3 program -- concentration of funding based on educational need.

The results shown in Table 9 regarding other funding sources is explained as follows. The most of these other funds were from the state funded Section 43 reading program. These funds are available to Title I eligible schools which do not receive Chapter 3 funds. Thus, the increased level of allocation of these funds in the high achieving sites mirrors the decreased allocation of Chapter 3 funds just described.

Relationship Between Program Costs and Observed 1974-75 Achievement Scores

The cost analysis presented so far in this section dealing with high achieving vs. low achieving groups of programs were based on program success designations reflecting 1973-74 achievement data for these programs. However, another possible way of examining the relationship between program cost in 1974-75 and program success in 1974-75 is to directly explore the relationship between the two. Program cost results for 92 of the 9[illegible] programs studied have just been presented and analyzed in some detail. Considering only those programs for which both cost results and achievement results were available for the 1974-75 school year, a total of 80 programs provided such data.

Figure 1 is a scatter diagram of the achievement results (vertical axis) and program results (horizontal axis) for these 80 programs. Note the legend showing the four groupings of programs reflected in this exhibit:

1) high achieving Title I sites; O
2) high achieving Chapter 3 sites; □
3) low achieving Title I sites; and ●
4) low achieving Chapter 3 sites. ▪

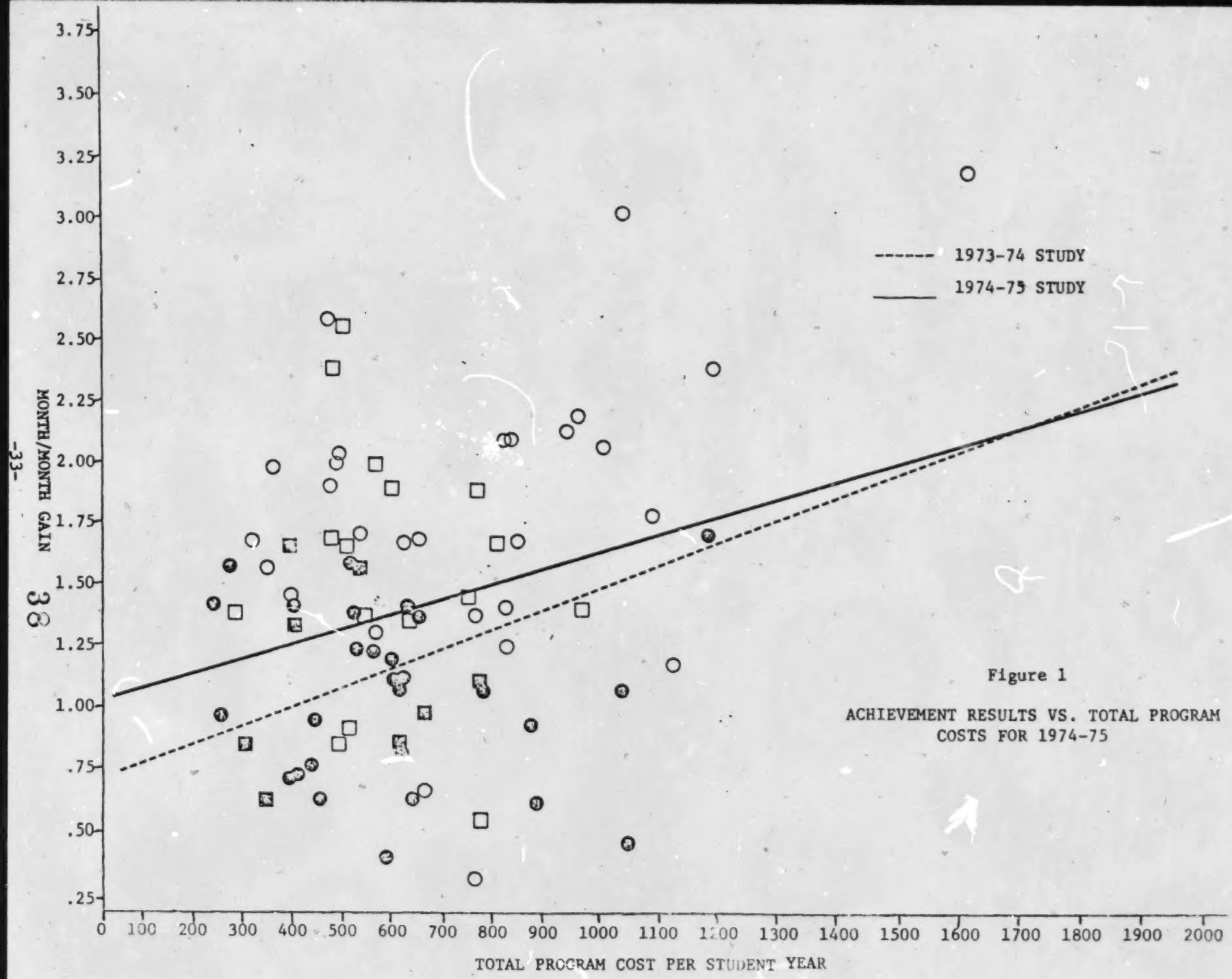

Figure 1

ACHIEVEMENT RESULTS VS. TOTAL PROGRAM COSTS FOR 1974-75

Also shown in Figure 1 is the least squares regression line which best fits these 80 points. This line, for the 1974-75 study is shown as a solid line. The dotted line also shown in this figure represents the regression line which best fits the 48 data points available from last year's study. The equations for these two regression lines are as follows:

1974-75

month/month gain = 1.0016 + 0.000774 (total program cost)
(r = 0.2913; regression coefficient is significant at the 0.004 level)

1973-74

month/month gain = 0.697 + 0.000941 (total program cost)
(r = 0.5514; regression is significant at the 0.00005 level)

Thus, it can be seen that while the slope of this year's regression line is not as steep as last year's, a significant relationship between month/month gain and total program cost exists in this year's data paralleling a major finding of last year's study effort. Further, there is not significant difference between the slopes of the two regression lines shown in this figure, though this year's line is somewhat less steep.

As a further analysis, the relationships between each of the 9 major subtotals of total program cost discussed earlier in this section and month/month gain were also investigated. **Table** 10 shows the Pearson correlation coefficient between each of these cost subtotals and compensatory education reading achievement for the 1974-75 data. The correlation result for total program costs have been included in this figure as well for reference purposes. Three of the five cost subtotals dealing with specific activities show a significant positive correlation with program achievement results: classroom reading activities, planning, and decision making. Note that decision making shows the

highest correlation of these three activities but that none of the correlation coefficients for these specific activity cost subtotals is larger than the correlation for total program cost.

TABLE 10

CORRELATIONS BETWEEN MAJOR COST SUBTOTALS AND MONTH/MONTH GAIN ACHIEVEMENT RESULTS FOR THE 1974-75 STUDY SAMPLE

COST SUBTOTAL	r (between month/month gain and cost subtotal)	r^2
Total Program Cost	+0.2913*	0.0848
Specific Activity Cost:		
Classroom Reading Activities	+0.2019*	0.0407
Planning for Comp. Ed. Reading	+0.2091*	0.0437
Training for Comp. Ed. Reading	+0.0795	0.0063
Decision Making for Comp. Ed. Reading	+0.2753**	0.0757
Administrative Activities for Comp. Ed. Reading	+0.1094	0.0119
Costs Provided from Various Funding Sources:		
Local General Fund	+0.0822	0.0067
Title I Funds	+0.3629**	0.1316
Chapter 3 Funds	-0.1000	0.0100
Other Fund Sources	+0.0703	0.0049

*Significant at the 0.05 level but not at the 0.01 level.
**Significant at the 0.01 level or lower.

Only one of the four cost subtotals dealing with costs provided from various funding sources shows a significant positive correlation with program achievement results -- Title I funding allocation. Note that this particular correlation coefficient is larger than that for total program cost.

SECTION VI

EFFECTIVENESS ANALYSES

In this section of the report, the results of the effectiveness analyses conducted using the 1974-75 achievement data are described. The purpose of these analyses was to identify those conditions, activities, or things (policy variables) which are related to student reading achievement. While the previous section indicated that the amount of resources allocated to reading instruction was related to student reading achievement, it was actually those conditions, activities, and things purchased by the resources that were related to the student reading achievement.

The effectiveness analyses can be separated into two general groups. The first group is used to determine which of the policy variables under investigation discriminated between the high and low achieving sites. The product of this first group of analyses is a set of variables which significantly discriminated between high and low sites. The second group of analyses is concerned with each of the individual variables that were identified by the first group of analyses. The various sites are divided into either: 1) two groups reflecting a high degree or a low degree of the policy variable being studied (in the case of quantitative variables) or 2) groups representing the various categories of the policy variable (in the case of qualitative variables). The reading achievement gains observed for these various groups were then examined to determine if reading achievement varied according to these groups. In this way, the data gathered during any given year of the Cost-Effectiveness Study was examined twice.

During the first year (1973-74) of the study, 45 policy variables were found to discriminate between high and low achieving sites. The high and low sites for this first year of the study were identified using 1972-73 reading achievement data. The second step of the first year analyses was to determine if the 45 identified variables were significantly related to the 1973-74 reading achievement gains at the .05 level. It was found that 17 of the 45 variables were significantly related to the 1973-74 reading achievement gains. In other words, the first year of the study identified 17 policy variables that were cross-validated over two years of reading achievement results.

The effectiveness analyses for the second year of the study (1974-75) were conducted in the same manner as in the first year of the study. There was one modification in the analysis plan for the second year. The pre-established significance level for the first year of the study was .05 for both sets of analyses. For the second year, the significance level for the first set of analyses, a general screening procedure, was initially set at .10 rather than .05.[4] The significance level for the second set of analyses remained at .05.

Cross-Validation of First Year Results

The first step of the second year analyses was to examine those variables which were found to be significant during the first year of the study. These variables included 37 of the 45 that were found to be significant during the first phase of the first year analyses. Also included in this analysis were those variables which were significantly related to achievement on the first phase of the first year analyses

[4] At this point, the significance level was changed back to .05 because the number of variables significant at the .10 level became unmanageable.

but not on the second phase of the first year analyses. It was found that 5 of the 37 variables included in the analysis discriminated significantly between the high and low achieving sites (site selection based on 1973-74 achievement results). These variables are listed in Table 11.

The next step in the analysis was to examine the 683 new/modified variables (i.e., those variables not included in the first year of the study) to determine if they discriminate between the high and low sites. This analysis showed there were 120 variables which discriminated between high and low sites at the .05 level or better. These variables are listed in Appendix A.

TABLE 11

EDUCATIONALLY SIGNIFICANT VARIABLES

Variable	Relationship to Reading Achievement
Principal (respondent)	
1. Number of teacher working hours at school daily	High number of hours was associated with high reading achievement
Compensatory Education Teacher (respondent)	
2. Fraction of materials selected by teacher	High fraction of materials selected was associated with high reading achievement
3. Days of training provided teachers at onset of project	Greater number of days was associated with high reading achievement
4. Did paraprofessionals	Except where paraprofessionals functioned as second teachers, assistance from paraprofessionals was associated with low reading achievement
5. Teacher morale	High teacher morale was associated with high reading achievement

The next step in the analysis was a phase two analysis for the second year; this analysis attempted to find out if groups based upon the variables that were significantly related to achievement in previous analyses were different in terms of 1974-75 reading achievement scores. Of these 120 variables, it was found that 36 were significantly related to the 1974-75 reading achievement scores. These variables were then examined (using non-statistical methods) to determine if there were any interrelationships within them. It was found that there were five groups of variables that were dealing with this same concept or topic. Those groups are listed in Table 12.

TABLE 12

CATEGORIES OF VARIABLES
RELATED TO READING ACHIEVEMENT

Category	Relationship to Reading Achievement
Degree to which accountability was implemented	High degree of implementation was associated with high reading achievement
Extent of paraprofessional involvement	High level of involvement was associated with low reading achievement
Involvement of private firms other than selling materials	Private firm involvement was associated with low reading achievement
Degree of program organization	High degree of program organization was associated with high reading achievement
Professional staff involvement	(A single relationship characterizing this group of variables has not been identified)

For those variables that were included in the first year of the study, it was possible that they would be included in four separate analyses: phase one and two for both year one and two. The question arose, how many analyses would be necessary for a variable to be significantly related to reading achievement before it could be said that it was an important variable with respect to reading achievement? Certainly, a variable which was significantly related to achievement of all four variables could be considered important. But would a variable which showed significant relationship only two of the four times he considered important? What about a variable which was related three times? These questions can be summarized into one question, what is the power of the statistic used to identify their relationship? Most statistical tests are performed in such a way to give a probability statement as to the chances of finding significance when no real significance exists. The power of any tests deals with the probability of not finding significant relationship when such a relationship does exist. Since the t-test was used more than any other given statistic and means of calculating its power are readily available, it was decided to examine the power of the t-test given the population scores with which the study deals. It was found that the power of most of the t-tests, for the .05 level, range from approximately .6 to .7 with few examples going above .75. These figures had an average of approximately .67.

The implication of this result is that it could be expected that if a true relationship existed between some variable and achievement, the typical t-test used in the study would detect that relationship only two out of three times. It was decided at that point to include as educationally significant variables any variable which was found to be related to achieve-

ment three out of four analyses. This is a conservative choice in that three out of four is above the two out of three ratio established above.

TABLE 13

VARIABLES RELATED TO READING ACHIEVEMENT ON THREE OF FOUR ANALYSES DURING 1973-74 AND 1974-75 STUDY YEARS

Variable	Relationship to Reading Achievement
Principal (respondent)	
1. Number of teacher working hours at school daily	High number of hours was associated with high reading achievement
2. Principal's satisfaction with regular teacher's coordination, of reading services with compensatory education reading services	High level of satisfaction was associated with high reading achievement
Compensatory Education Teacher (respondent)	
3. Fraction of materials selected by teacher	High fraction of materials selected was associated with high reading achievement
4. Days of training provided teachers at onset of project	Greater number of days was associated with high reading achievement
5. Did paraprofessionals help teacher	Except where paraprofessionals functioned as second teachers, assistance from paraprofessionals was associated with low reading achievement
6. Teacher morale*	High teacher morale was associated with high reading achievement

Those variables included in both years of the study were examined so as to determine how many times they were shown to be significantly related to reading achievement. Those variables which were significantly related

to achievement at least on three of the four analyses are included in Table 13. It should be noted at this point that only one variable was related to achievement on all four analyses; that variable is noted with an asterisk in the Table.

Tables 12 and 13 contain 11 variables or groups of variables which have been found over one or both years of the study to be significantly related to reading achievement. The remainder of the effectiveness analysis is concerned only with these 11 variables or groups of variables. The number of variables considered was actually reduced to 7. The group of variables representing professional staff involvement was dropped because no single measure characterizing this group of variables has been identified; continuing analyses will address this problem. A group of variables concerning the extent of paraprofessional involvement was dropped in favor of the variable in Table 11 representing the nature of paraprofessional involvement. Finally, the variables, in Table 11, pertaining to the number of hours teachers spend at school daily and the fraction of materials selected by the compensatory education teacher were dropped. These variables were dropped because they were not significantly related to reading achievement on the fourth and last of the analyses. The data, primarily correlation coefficients, for the remainder of the effectiveness analyses was obtained from the fourth series of analyses. Without a significant correlation between these variables and reading achievement it was decided not to use them in the analysis.

Thus, the final set of analyses was performed on 8 variables including reading achievement gains. These variables and their correlations are shown in Table 14.

TABLE 14

INTERCORRELATION MATRIX FOR VARIABLES
INCLUDED PATH ANALYSES

Variable	Variable Number	Variable Number						
		2	3	4	5	6	7	8
Days training*	1	-.17	-.19	-.05	.00	.07	.11	.21
Paraprofessional Involvement	2		-.12	-.17	.12	-.08	-.04	.20
Teacher Morale	3			.18	.12	.42	.24	.28
Private Involvement	4				-.31	-.20	.03	-.18
Degree of Accountability	5					.35	.00	.24
Degree of Program Organization	6						.10	.22
Principal Satisfaction with Teacher Coordination	7							.31
Reading Achievement	8							

* See Tables 12 and 13 for more detailed descriptions of variables.

Based on previous analyses, it is known that the variables in Table 14 are related to reading achievement. However, the previous analyses do not provide an indication as to how those variables are related to reading achievement and to each other. To determine the nature of these relationships, it was decided to use path analysis as described in Multiple Regression and Behavorial Research, Kerlinger and Pedhazur. It should be noted at this point that path analysis is not a means of identifying causes but a means of determining which of various proposed explanations of reality best fit the data at hand.

The path model shown in Figure 2 was developed from the correlations shown in Table 14. It was the first path model for which a complete path analysis was calculated. Notice that the arrows between the various boxes represent the hypothesized directions of the relationships between the variables. For example the arrow between variable 3, teacher morale, and variable 8, student achievement, indicates that it was hypothesized that teacher morale affected student achievement. The correlation between teacher morale and student achievement was .28. This is shown alongside the arrow connecting those two variables. The figure in the parentheses below the correlation of .28 is the reproduced correlation. The degree to which the hypothesized path model reflects the reality of the data at hand is shown by the agreement between the correlation and the reproduced correlation in the parentheses. For certain relationships between the variables, the path coefficient was not calculated. For example, no path coefficient was calculated for the relationship between variable 4, presence of private firms, and variable 5, degree of implementation of accountability. Where only one variable is hypothesized to affect another variable (only variable 4 was hypothesized to affect variable 5), the correlation between the two variables is identical to the path coefficient between the two variables.

Model 5A, shown in Figure 2, shows that the agreement between the correlation and reproduced correlations between the variables of teacher morale, preservice training, and paraprofessional involvement and the variable achievement were not high. This disagreement between the correlations and the reproduced correlation indicates that Model 5A is not a good representation of reality as represented by the data at hand.

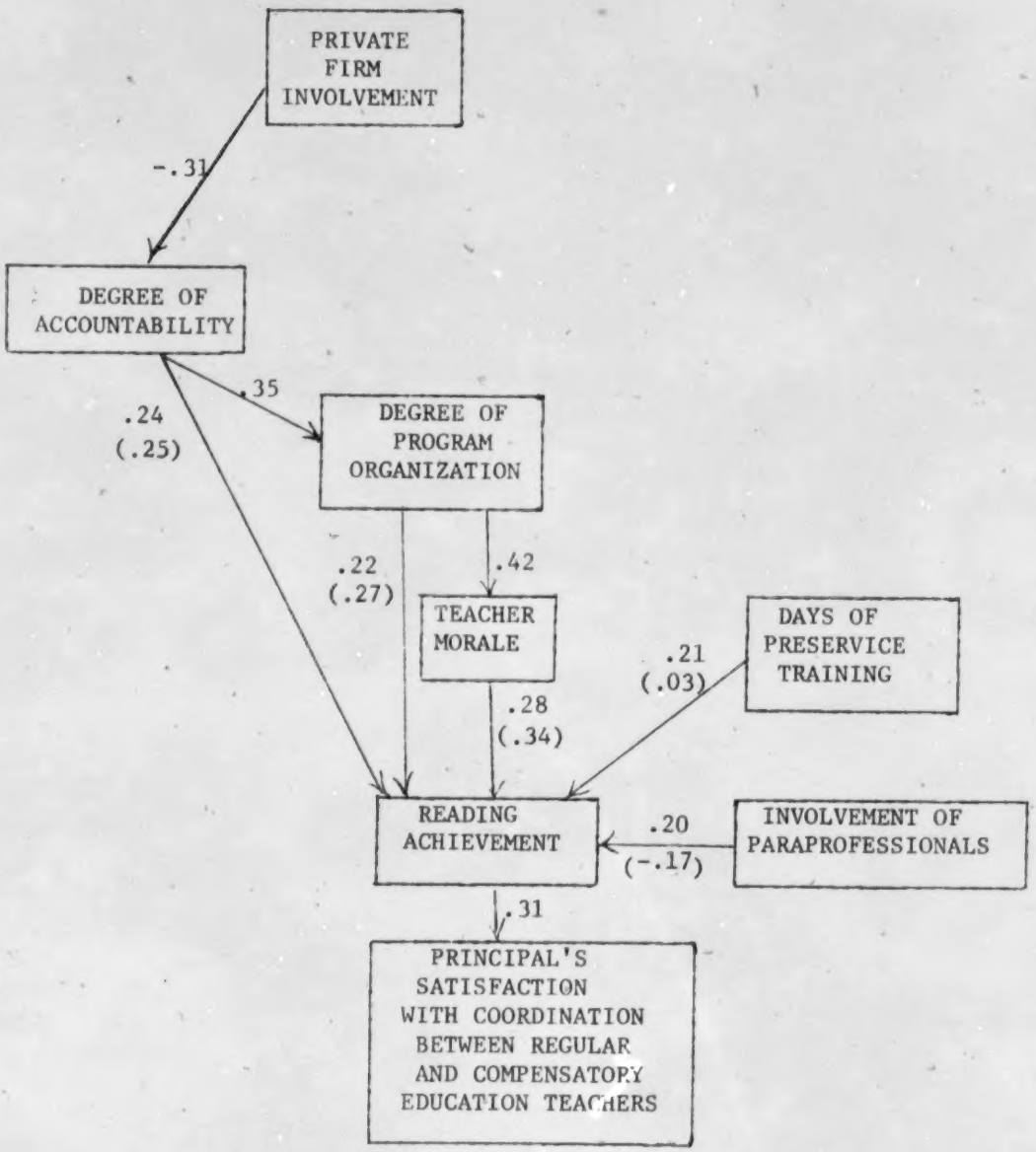

Figure 2

Path Analysis Model 5A

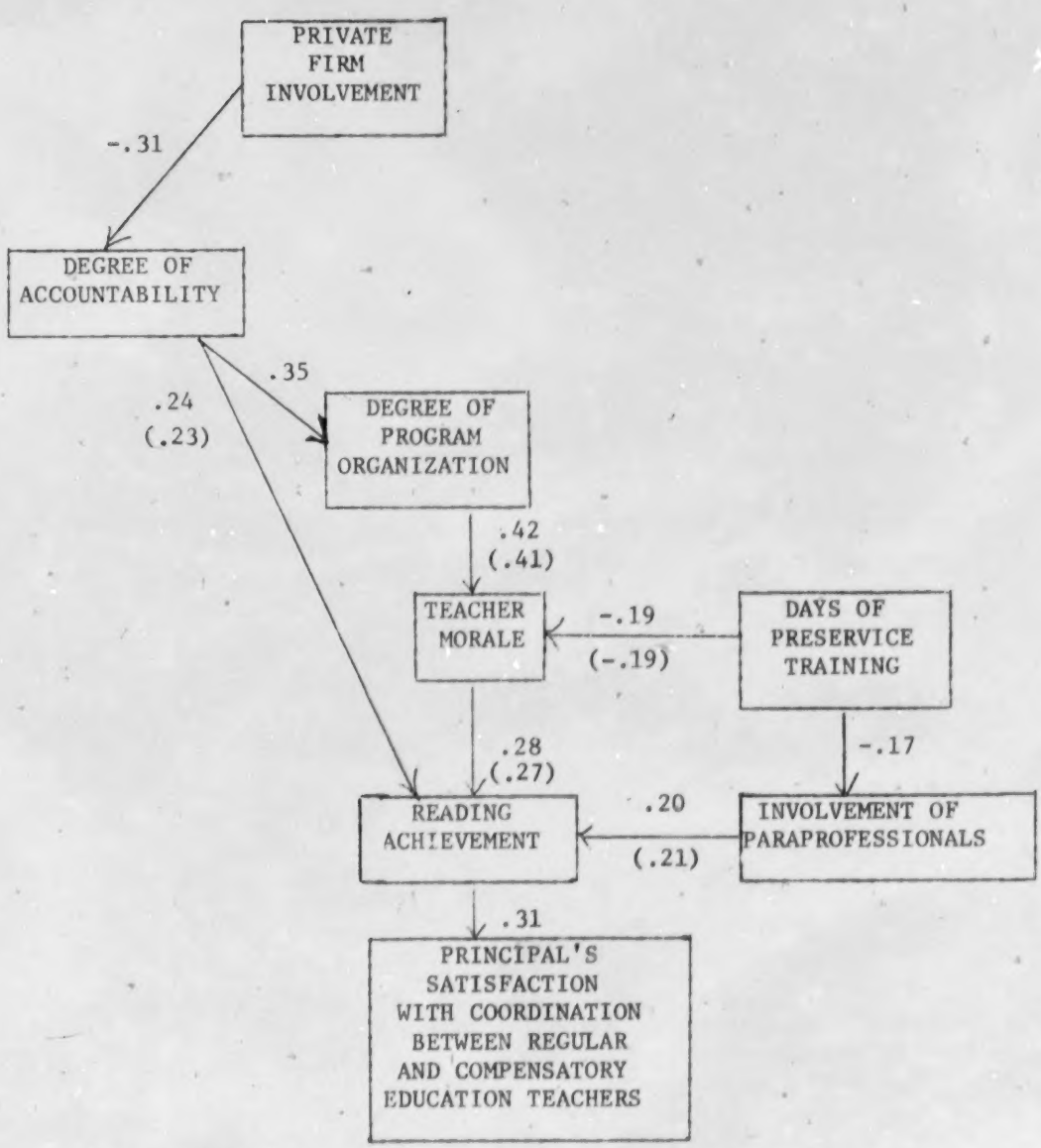

Figure 3

Path Analysis Model 12

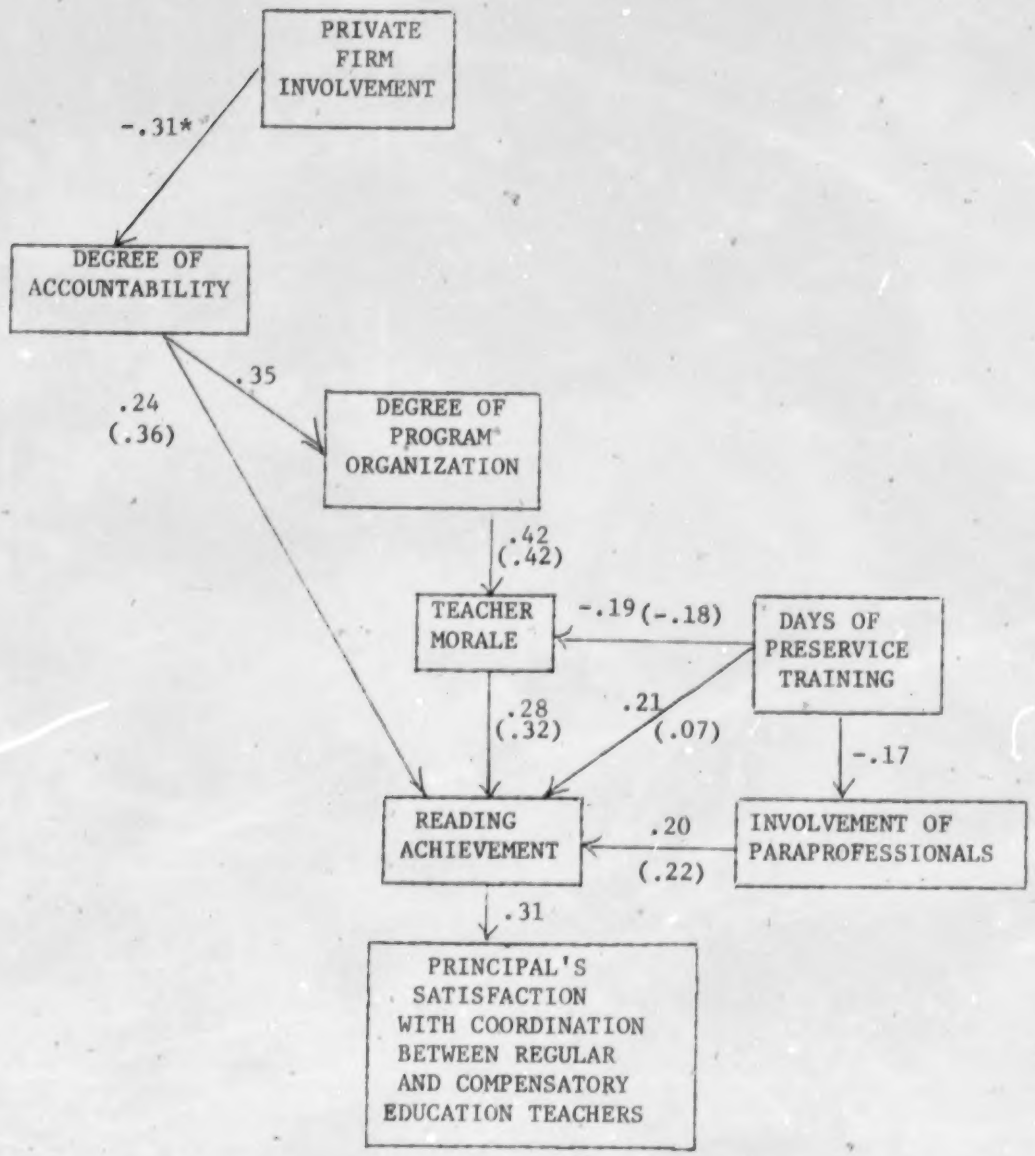

Figure 4

Path Analysis Model 14

While many models were examined, the next model presented in Figure 3 showed a high degree of agreement between the correlation coefficients and their respective reproduced correlations. While Model 12 did represent the best fit with the data at the point in time it was developed, further path analyses were performed. Model 14 in Figure 4 represents a minor modification of Model 12. As can be seen from the degree of agreement between the correlations and reproduced correlations in Model 14 and those in Model 12, Model 12 does represent a better fit with the data at hand than does Model 14. Because Model 12 is less complex than Model 14 and is a better fit with the data at hand than Model 14, it was selected as being a superior model.

At this point, it was decided that Model 12, presented in Figure 3, represented a sufficiently accurate model of reality as represented by the data available.[5] This is not to say that further analyses would not find a model which would better fit the data. Moreover, it is now a challenge to demonstrate, through systematic analysis, that there is another model which better fits reality.

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[5] Fifteen path models were analyzed. Models 5A and 14 were the most complex models considered.

SECTION VII

SUMMARY, CONCLUSIONS, AND RECOMMENDATION

Summary

The purpose of this report is to provide a description of the 1974-75 Michigan Cost-Effectiveness Study and its findings. As was the case with the first year of the study, 1973-74, the 1974-75 study was restricted to compensatory education reading programs. The study was an effort to develop and implement evaluation techniques which can determine what educational practices bring about changes in student behavior and what costs are associated with those practices.

The Cost-Effectiveness Study has focused upon educational variables which could be changed or controlled by educational systems. Variables such as race, social economic status, level of parental education, and so forth, which cannot be readily controlled or modified by an educational system were not examined. It was the intent of the study to examine those aspects of educational policy and practices which could be changed to bring about a higher quality of education for students.

The design implemented for the first year of the Cost-Effectiveness Study consisted of two components. An effectiveness component was developed and integrated into the cost component derived from the COST-ED model. The criterion for measuring effectiveness was grade equivalent gains measured on a month per month in program basis using standardized norm-referenced tests administered by participating districts. Process variables were used as independent variables and, through various analytical techniques, were contrasted between successful and

unsuccessful programs to determine if any significant relationship existed. The COST-ED model was modified and used to determine the costs associated with variables and practices significantly related to program success.

The overall purpose of the 1974-75 study was the continued development of the analytical techniques reflected in the cost-effectiveness model. However, a critical part of this continued development was considered to be a cross-validation effort focusing upon the variables identified and reported in the executive summary of the 1973-74 study. The importance of cross-validation rests in the need for evidence upon which to anchor the overall findings, evidence that involves the demonstration of significant results over more than one year of the study.

Following, in importance, the cross-validation of the reported results of last year's effort is the identification of new variables which relate to achievement.

The third and last purpose of the 1974-75 effort was the investigation of the direction of the relationships between achievement and various identified variables. The development of the path models presented in Section VI do represent a major step in identifying the nature of the significant relationships between various variables and reading achievement.

For the 1974-75 study year, a number of changes in the overall study design were carried out. Two buildings per study site were included in the sample, both the highest and lowest achieving buildings from each district (site) regardless of whether the district was selected as a high or low achieving site. This basic change, from 1973-74, in the design was carried out in order to investigate within school district

variables. Because of this change in design, districts having only one elementary school were included in the study. Thus, the study sample for the 1974-75 study year tended to include districts which on the average were larger than the previous year's study sample.

Following the overall dimensions intended for the 1973-74 study, the site selection process resulted in identifying 25 districts in Michigan highly successful in their compensatory education reading programs and 25 that were highly unsuccessful. Thirty six of these 50 districts were to be included for their Title I programs; fourteen for their Chapter 3 programs.

Data collection took place between March and June of 1975. The procedures followed paralleled those of the 1973-74 effort. Once both buildings for a site has been identified and scheduled for a visit, letters were sent to the district's director of compensatory education and the principals of each study school confirming these arrangements and alerting these persons to data needs that they might more easily fulfill prior to the on-site visit. These needs were expressed as specific requests for enrollment data, roster of compensatory education students, and budget documents. The typical site visit included interviews with one director, two principals, two compensatory education teachers, six to eight regular classroom teachers, three or four paraprofessionals, plus one other staff for a total of 16-17 such interviews.

The following background characteristics were compared for successful and unsuccessful sites:

1) Median Family Income in District, Dollars Annually
2) Total General Fund Expenditure ($) per Student
3) Total Compensatory Education Expenditure ($) per Compensatory Education Student (Title I for Title I sites, Chapter 3 for Chapter 3 sites)

4) Number of Title I Students
5) Number of Chapter 3 Students
6) District Enrollment
7) Kindergarten
8) Grades 1-6
9) Grades 7-12
10) K-12
11) Number of Elementary Schools in the District
12) Number of Title I Elementary Schools
13) Number of Chapter 3 Elementary Schools
14) Number of Elementary Schools Which are Both Title I and Chapter 3

There were no significant differences between the two groups of sites on these characteristics.

A major difference in scope between the 1973-74 and 1974-75 study was the inclusion of two schools per site: one high achieving school and one low achieving school. It was found that the difference in acheivement between sites was significant but that the comparison of all high achieving schools (regardless of site designation) to all low achieving schools showed no significant difference in reading achievement. With this result in mind, buildings from high achieving sites were designated high achieving buildings and buildings from low achieving sites were designated low achieving buildings.

Four cost analyses were presented. The first analysis dealt with comparisons of <u>total program costs</u> between the high achieving and the low achieving programs. The second analysis dealt with similar comparisons but used five separate subtotals which make up the total program cost (subtotals that reflect the <u>cost of specific activities comprising the overall program</u>) as the basis for comparison. The third analysis dealt again with similar comparisons but used four other subtotals which also add to the total program cost (in this case the subtotals reflect the

amount of resources from various funding sources that make up the total program cost) as the basis for comparison. The last of the cost analyses examined the relationship between total program cost (as well as each of the nine different cost subtotals described above) and the month/month gain results presented in the previous section.

This study determined the cost of all resources devoted to reading instruction for compensatory education students for each school in the study. The phrase "cost of all resources devoted to reading instruction for compensatory education students" has a very specific meaning which the reader should clearly understand. That meaning is that any cost incurred, by school district staff, performing the functions of compensatory education reading: 1) instruction, 2) planning, 3) training, 4) decision making, and 5) administration.

A comparison of total program costs for high achieving sites and low achieving sites showed that the total program cost for high achieving sites was significantly greater than the total program cost for low achieving sites. The cost per student for high achieving sites was $635 as compared to $459 for the low achieving sites. The cost analyses showed that for the function of planning, training, decision making, and administrative activities related to the compensatory education reading program, the high achieving sites devoted significantly more resources than did the low achieving sites. For classroom (student contact) reading activities, the high achieving sites devoted more resources than did the low achieving sites; but the difference was not statistically significant.

Three of the four fund sources examined showed high achieving sites allocated significantly larger dollar amounts per pupil than did low achieving sites. Only the costs provided from Chapter 3 funds show no difference between the high and low achieving sites. Actually more Chapter 3 funds were allocated to the compensatory reading programs in low achieving sites in the study sample though the difference is not statistaically significant.

The cost analyses presented in the first three sets of analyses dealt with high achieving vs. low achieving groups of sites, based on program success designations reflecting 1973-74 achievement data for those sites. Comparing program costs to 1974-75 reading achievement resulted in finding that the following cost categories (in terms of annual per pupil cost) were significantly related to reading achievement:

1) Total Program Cost
2) Cost of Classroom Reading Activities
3) Cost of Planning for Compensatory Education Reading
4) Cost of Decision Making for Compensatory Education Reading
5) Title I Funds

In all five cases, higher costs were associated with high reading achievement.

The purpose of these effectiveness analyses was to identify those conditions, activities, or things (policy variables) which are related to student reading achievement. While the cost analyses indicated that the amount of resources allocated to reading instruction was related to student reading achievement, it was actually those conditions, activities, and things purchased by the resources that were related to the student reading achievement.

The effectiveness analyses was separated into two general groups. The first group was used to determine which of the policy variables under investigation discriminated between the high and low achieving sites. The second group of analyses was concerned with each of the individual variables that were identified by the first group of analyses. The various sites were divided into either: 1) two groups reflecting a high degree or a low degree of the policy variables being studied (in the case of quantitative variables) or 2) groups representing the various categories of the policy variable (in the case of qualitative variables). The reading achievement gains observed for these various groups were then examined to determine if reading achievement varied according to these groups. In this way, the data gathered during any given year of the Cost-Effectiveness Study was analyzed twice.

The results of the first year of the Cost-Effectivenses Study showed that 45 variables varied significantly between the high and low study sites. Since these sites were selected on the basis of 1972-73 reading achievement data, it was desired to determine if any of these 45 variables were related to the 1973-74 reading achievement results. Further analyses indicated that 17 of the 45 variables were significantly related to the 1973-74 reading achievement results. The 1974-75 data analyses examined, where possible, the 45 variables from the first year of the study to determine if they were related to reading achievement based upon the second year results. These variables were examined with respect to the high and low achieving

sites (which were based upon 1973-74 achievement data) and with respect to the 1974-75 reading achievement. Thus, over a period of two years, there were four separate analyses which examined the relationship between the 45 variables previously mentioned and reading achievement.

Those variables which were found to be significantly related to reading achievement in three of the four analyses were considered to be variables whose relationship to reading achievement were considered to be educationally significant.

In addition to the 45 variables discussed above, there are variables which were modifications of variables used in the first year of the study and variables that were completely new to the study in the second year. These variables were analyzed by determining if they were related to high and low achieving sites and then also to determine if they were related to 1974-75 achievement results. Thus, these variables were analyzed only twice. Of these variables, it was determined to focus upon those which were found to be significantly related to reading achievement for both of the analyses. There were 36 such variables. An examination of the 36 variables indicated that there were five general categories into which most of these variables could be classified.

Eleven variables or groups of variables were found, over one or both years of the study, to be significantly related to reading achievement. The remainder of the effectiveness analysis was concerned only with these 11 variables or groups of variables. The variable representing professional staff involvement was dropped because no single measure characterizing this group of variables has been identified. A group of variables concerning the extent of paraprofessional involvement was dropped in favor of a variable representing the nature of para-

professional involvement. Finally, the variables pertaining to the number of hours teachers spend at school daily and the fraction of materials selected by the compensatory education teacher were dropped. These variables were dropped because they were not significantly related to reading achievement on the fourth and last of the analyses. The data, primarily correlation and coefficients, for the remainder of the effectiveness analyses was obtained from the fourth series of analyses. Without a significant correlation between these variables and reading achievement it was decided not to use them in the path analysis. Thus, the final set of analyses was performed on eight variables including reading achievement gains.

To determine the nature of these relationships between those eight variables, it was decided to use path analysis as described in Multiple Regression and Behavioral Research, Kerlinger and Pedhazur. Path analysis is not a means of identifying causes but a means of determining which of various proposed explanations of reality best fit the data at hand. Path analysis could yield different results with a different set of data. Path analysis does assist the researcher in determining which of various explanations best fit the available data.

While many models were examined, one model was shown to possess a high degree of agreement between the correlation coefficients and their respective reproduced correlations. While Model 12, presented in Figure 3, did represent the best fit with the data at the point in time it was developed, further path analyses were performed. However, no other model was found which gave a higher degree of agreement between the correlation coefficients and their respective reproduced correlations. It was decided that Model 12 represented a sufficiently accurate model of reality as represented by the data available. This is not to say

that further analyses would not find a model which would better fit the data. Moreover, it is now a challenge to demonstrate, through systematic analysis, that there is another model which better fits reality.

Conclusions

1. A set of procedures have been developed which when implemented can:

   a) identify those costs, in terms of resources used, which may be associated with a desired educational product;

   b) identify those policy variables which may be associated with a desired educational product; and

   c) identify the most plausible model(s) which describes the nature of the association between the policy variable and educational product.

2. It has been shown that for extremely high and extremely low achieving compensatory education reading programs in Michigan:

   a) higher per pupil program costs are associated with a higher reading achievement; and

   b) certain policy variables, see Figure 4, page 47, do appear to have significant impacts on student compensatory education reading achievement. The variables Teacher Morale, Degree of Accountability, and Involvement of Paraprofessionals were the only variables which were shown to have direct impact on student reading achievement.

Recommendation

It is recommended that the results of the Michigan Cost-Effectiveness Study be implemented on a pilot basis in a small number of schools where student reading achievement is low. The goal of the pilot implementation would be to determine if student reading achievement can be raised as a result of changes based upon the Cost-Effectiveness Study results.